

MULTIMEDIA



UNIVERSITY

STUDENT ID NO

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MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2017/2018

PCM0235 - CALCULUS

(Foundation in Information Technology/ Foundation in Life Sciences)

14 OCTOBER 2017
2.30p.m – 4.30p.m
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This Question paper consists of 2 pages excluding the cover page and appendix.
2. Answer **all FIVE** questions. Each question carry equal marks and the distribution of the marks is given.
3. Write all your answers in the Answer Booklet provided.

Answer All Questions.

Question 1 (10 marks)

a) Find the following limits.

i. $\lim_{x \rightarrow 0} \frac{\sin^2 5x}{8x^2}$ (3 marks)

ii. $\lim_{x \rightarrow -\infty} \frac{5x^3 + 2x^2}{x^2 + x + 7}$ (2 marks)

iii. $\lim_{x \rightarrow 1} \frac{\sqrt{x+4} - \sqrt{5}}{x-1}$ (3 marks)

b. A function $f(x)$ is given as $f(x) = \begin{cases} \frac{x^2-4}{x-2}, & x < 2 \\ kx+5, & x \geq 2 \end{cases}$.

Determine the value of k such that the function is continuous for all real numbers. (2 marks)

Question 2 (10 marks)

a) Find the first derivative given:

i) $y = (3x^2 - 2)(4x^3 + 1)^3$. (3 marks)

ii) $y = \frac{x^3}{\tan 8x}$. (3 marks)

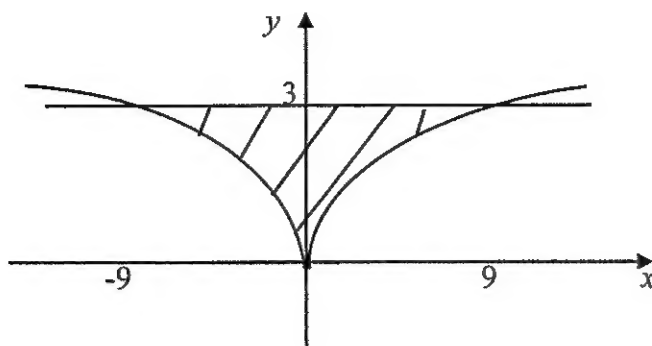
b) Find the equation of the tangent line to the curve $y = \ln(2x^2 + ex)$ at the point $x = 2e$. (4 marks)

Question 3 (10 marks)

a) Find the local maximum, local minimum, interval of increasing and interval of decreasing for the function $f(x) = x^4 - 4x^3 + 4x^2$. (5 marks)

Continued...

- b) Let R the region bounded by $y = \sqrt{x}$, $y = \sqrt{-x}$ and $y = 3$ is given below.



Find the area of region R.

(5 marks)

Question 4 (10 marks)

- a) Solve the given first order differential equation, $\frac{dy}{dx} - 2y = 4$. (4 marks)
- b) Solve the given second order differential equation.
 $y'' - 6y' + 9y = 0$, $y(0) = 2$, $y'(0) = -1$. (6 marks)

Question 5 (10 marks)

- a) Evaluate:
- $\int \left(\frac{x^2 - 4x - 5}{x + 1} + \sin 3x \right) dx$. (3 marks)
 - $\int_0^2 3x^2 e^{6x^3} dx$. (2 marks)
- b) Use integration by part to evaluate $\int x^2 \cos x dx$. (5 marks)

End of Page

APPENDIX

A. Differentiation Rules

$$\frac{d}{dx}[x^n] = nx^{n-1} ; n \text{ is any real number}$$

$$\frac{d}{dx}[f(x).g(x)] = f(x)g'(x) + f'(x)g(x) \quad ; \text{ The Product Rule}$$

$$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{g(x)f'(x) - f(x)g'(x)}{[g(x)]^2} ; \quad \text{The Quotient Rule}$$

$$\frac{d}{dx}[f(g(x))] = f'(g(x)).g'(x) ; \quad \text{The Chain Rule}$$

$$\frac{d}{dx}[g(x)]^n = n[g(x)]^{n-1}.g'(x) ; \quad \text{The power rule combined with the chain rule:}$$

$$\frac{d}{dx}[\sin x] = \cos x \qquad \frac{d}{dx}[\cos x] = -\sin x \qquad \frac{d}{dx}[\tan x] = \sec^2 x$$

$$\frac{d}{dx}[\sec x] = \sec x \tan x \qquad \frac{d}{dx}[\cot x] = -\csc^2 x \qquad \frac{d}{dx}[\csc x] = -\csc x \cot x$$

$$\frac{d}{dx}[e^x] = e^x \qquad \frac{d}{dx}[\ln x] = \frac{1}{x}; \quad x > 0$$

B. Basic Integration Formulas

$$\int cf(x) dx = c \int f(x) dx \qquad \int k dx = kx + C$$

$$\int [f(x) \pm g(x)] dx = \int f(x) dx \pm \int g(x) dx \qquad \int x^n dx = \frac{x^{n+1}}{n+1} + C, \quad n \neq -1$$

$$\int e^x dx = e^x + C \qquad \int \frac{1}{x} dx = \ln|x| + C$$

$$\text{Integration by-parts: } \int u dv = uv - \int v du$$

$$\text{Volume (disk)} = \pi \int_a^b (f(x))^2 dx$$

$$\text{Area} = \int_a^b (f(x) - g(x)) dx$$

$$\text{Volume (washer)} = \pi \int_a^b [(f(x))^2 - (g(x))^2] dx$$